Structure and dynamics of carbon nanopeapods

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Carbon nanopeapods (CNPP) are formed by C_{60} fullerene chains confined inside the hollow core of single wall carbon nanotubes (SWNT). They have been the center of intense research both experimental and theoretical [1].

In this communication we will present a complete neutron study of the dynamics of the fullerenes confined inside the nanotubes. We will discuss the density of states in the full energy range [0, 200 meV]. The low frequency part of the spectra which is sensitive to the diffusive behavior of the fullerenes (free rotations and/or translational diffusion along the nanotubes) will be presented and discussed in comparison with molecular dynamics simulations.

In a second part, we will show that the application of a high pressure / high temperature treatment on the "monomer" phase of the CNPP implies the polymerization of the C_{60} as a 1D chain where the fullerenes are linked by the so called (2+2) cycloaddtion [2]. The phase diagram of these new all carbon nano-compounds have been studied by X-ray diffraction, Raman spectroscopy and inelastic neutron scattering.

[1] J. Cambedouzou, V. Pichot, S. Rols, P. Launois, P. Petit, R. Klement, H. Kataura and R. Almairac, *Eur. Phys. J. B* **42***,* 32 (2004).

[2] M. Chorro, S. Rols, J. Cambedouzou, L. Alvarez, R. Almairac, J.-L. Sauvajol, J.-L. Hodeau, L. Marques, M. Mezouar, H. Kataura, *Phys. Rev B* **74**, 205425 (2006).